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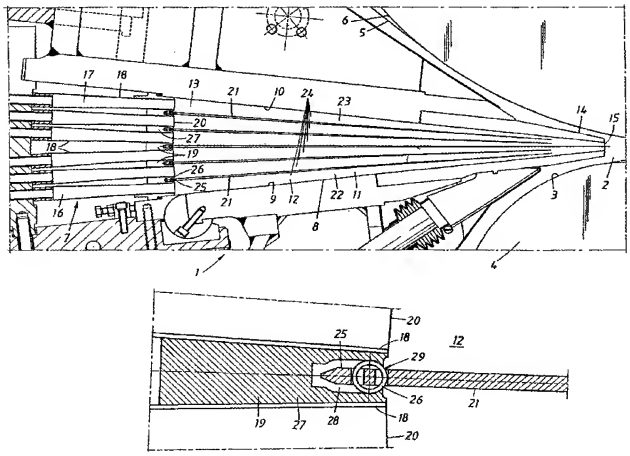
(54) Title: HEADBOX AND ARRANGEMENT FOR MOUNTING A VANE THEREOF



(57) Abstract: A headbox for delivering a jet of stock to a forming zone in a former for wet-forming a fiber web, comprising at least one vane (21), arranged in the slice chamber (12) of the headbox, and an arrangement for mounting the vane to the turbulence generator (7) of the headbox, said arrangement comprising an engagement member (26) connected to the vane at its upstream end portion (25), and an elongate structural element (27) with a longitudinal groove (28; 34) for receipt of the upstream end portion and its engagement member for securing the vane in the machine direction. In accordance with the invention the engagement member comprises oblong engagement bodies (40; 51) and the upstream end portion is provided with oblong recesses (41; 50) arranged at predetermined distance from each other, extend parallel with the upstream edge (42) of the vane at a distance therefrom and receive at least one engagement body for detachable mounting the engagement body in the upstream end portion of the vane. The invention also relates to such a mounting arrangement.

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Headbox and arrangement for mounting a vane thereof

The present invention relates to a headbox for delivering a jet of stock to a forming zone in a former for wet-forming a fiber web, comprising

- a slice having a slice chamber and a slice opening,
- a turbulence generator for supplying at least one stock to the slice chamber,
- at least one vane arranged in the slice chamber, and
- an arrangement for detachably mounting the upstream end portion of the vane in the headbox, said arrangement comprising
  - an engagement member connected to the vane at said upstream end portion, and
  - an elongate structural element with a longitudinal groove and being open at its opposing ends for receipt of the upstream end portion of the vane and its engagement member for securing the vane in the machine direction.

The invention also relates to an arrangement in a headbox for detachable mounting of the upstream end portion of a vane therein, said headbox being arranged to deliver a jet of stock to a forming zone in a former for wet-forming a fiber web and comprising

- a slice having a slice chamber and a slice opening,
- a turbulence generator for supplying at least one stock to the slice chamber, and
- at least one vane arranged in the slice chamber, said arrangement comprising
- an engagement member connected to the vane at said upstream end portion, and
- an elongate structural element with a groove longitudinal and being open at its opposing ends for receipt of the upstream end portion of the vane and its engagement member for securing the vane in the machine direction.

In a known design of engagement members used in practice the engagement members consist of engagement dowels, generally designated rivets. The rivets are arranged in holes in the upstream end portion of the vane and have end portions protruding at right angles on both sides of the vane to cooperate with a groove in a structural element, e.g. an assembly bar in the turbulence generator, so that the vane is secured in the machine direction. SE 9800642-2 describes a headbox the vanes of which being mounted with the aid of engagement dowels that are enclosed by a sleeve of resilient material allowing lateral movement when influenced by forces from the side walls of the groove, said forces occurring when the vane is mounted in the assembly bar, or the like. Such rivets, with or without sleeves, must be manufactured especially for this purpose and in a special manner. The work of fitting the rivets into the holes carefully shaped in the vane is time-consuming. The arrangement of rivets for mounting the vane therefore becomes expensive. When the vane is mounted to the turbulence generator, the groove is left open in towards the slice chamber between the positions of the rivets and there is therefore a risk of fibers collection in the groove between the rivets. Such collections of fibers may cause difficulties when the vane is to be dismantled from the headbox.

A vane produced of a plastic material, e.g. glassfiber-reinforced epoxy plastic, absorbs moisture from the surroundings while it is being stored and transported. After being assembled in the headbox it will also absorb moisture from the surroundings, now consisting of the stocks. The vane has a narrowing thickness in the machine direction so that the parts situated downstream are thinner than the parts situated upstream. This means that moisture saturation will occur

earlier in the thinner part than in the thicker part. The vane will consequently become extended and thereby buckle at its free, downstream edge and the thin part extending therefrom, whereas the thicker part strives towards such an extension since it is still absorbing moisture. It will be understood that such buckling disturbs the stock layer profiles at the slice opening and upstream thereof.

Headboxes with arrangements for detachably mounting a vane at a turbulence generator are known through a large number of patent specifications. The known arrangements have engagement members in the form of continuous, transverse thicker parts or the like in the upstream edge of the vane, see for instance US 4,617,091, US 5,013,406, US 4,566,945, US 4,504,360 and EP 0 607 249 B1. The engagement members may also be rigidly mounted to the upstream edge or part of the vane, as shown in US 3,843,470, US 4,128,455 and US 4,445,974. The known engagement members, rigidly mounted to the vane or made in the form of thicker parts, form a continuous pivot in the groove in the turbulence generator so that fibers cannot penetrate into the groove. However, the pivot-forming engagement members may easily be damaged when the vane turns as the result of a pressure drop on one side of the vane, so that the pivot may encounter the front edges of the groove which may be relatively sharp.

The object of the present invention is to provide a multilayer headbox with its vane or vanes mounted directly or indirectly to the turbulence generator with the aid of an arrangement that is simpler to manufacture and to mount, and that is less expensive to manufacture than known arrangements that include rivets.

In accordance with the invention, both the headbox and the arrangement, are characterized in that the engagement member comprises a plurality of oblong engagement bodies

and that the upstream end portion of the vane is provided with a plurality of oblong recesses of predetermined length, said recesses being arranged at predetermined distance from each other, extending parallel with the upstream edge of the vane at a predetermined distance therefrom and being arranged to receive at least one of said engagement bodies for detachably mounting the engagement body in the upstream end portion of the vane.

The invention will be further described in the following with reference to the drawings.

Figure 1 is a sectional view in the machine direction of a part of a multilayer headbox, mounted to deliver a multilayer stock jet into a gap leading to a forming zone in a twin-wire former of roll type.

Figure 2 is a sectional view of an arrangement for directly mounting one of the vanes present in the slice chamber of the headbox in conjunction with a tube bank in the headbox according to Figure 1.

Figure 3 is a sectional view of an arrangement for indirect mounting of a vane to a tube bank, for instance.

Figure 4 is a view from above of a part of a vane in the headbox according to Figure 1.

Figure 5 is a side view of the vane according to Figure 4.

Figure 6 is an enlarged portion of the vane according to Figure 4, with an engagement member in accordance with a first embodiment consisting of recesses in the vane and engagement pipes for these.

Figure 7 shows three engagement pipes for cooperation with one of the recesses according to Figure 6.

Figure 8 is a sectional view along the line VIII-VIII in Figure 6, showing a tongue bent up to receive a short engagement pipe according to Figure 7.

Figure 9 is a view from above of a part of a vane with an engagement member in accordance with a second embodiment.

Figure 10 is a sectional view along the line X-X in Figure 9.

Figure 11 is a view from above of a vane made with a circular arc-shaped downstream edge for mounting in this shape in the headbox with engagement members similar to those in Figure 6.

Figure 12 shows the vane in accordance with Figure 11 in stretched condition by means of the forces exerted on the vane by the flows of stock.

Figure 13 is a sectional view of a vane divided into two vane sections, with an arrangement similar to that in Figure 2 for direct mounting of the two vane sections to each other.

The headbox 1 shown schematically in Figure 1 is arranged to deliver a two-layer jet of stock into a gap 2, leading to a forming zone in a twin-wire former of roll type. Only certain parts of the twin-wire former are shown. The twin-wire former has an inner forming wire 3, running in an endless loop, a rotatable forming roll 4 situated inside the loop of the inner forming wire 3, an outer forming wire 5 running in an endless loop, and a rotatable breast roll 6 situated inside the loop of the outer forming wire 5.

The headbox has a turbulence generator 7 which, in the embodiment shown in Figure 1, consists of or comprises a tube bank, and a slice 8 situated downstream of the turbulence generator 7, which comprises a bottom part 9, a top part 10 and two end walls 11 extending between the bottom part 9 and top part 10. The four structural elements 9, 10, 11 enclose between them a slice chamber 12 which from its upstream end 13 converges in the direction of the flow of stock and terminates at its downstream end 14 in a slice opening 15, the width of which can be adjusted by turning the top part 10 about an axis in relation to the bottom part 9 by means of a suitable actuator (not shown).

The turbulence generator 7 comprises two pipe sections 16, 17 for feeding two different stocks into the slice chamber 12, the lower pipe section 16 and the upper pipe section 17 each having three rows of pipes 18 arranged closely adjacent to each other. The rows of pipes 18 extend across the machine direction. The pipe sections 16, 17 are separated by an mounting bar 19 extending across the machine direction and connecting the pipe sections 16, 17 with each other. Similarly, two adjacent rows of pipes 18 are separated by similar mounting bars 19, also extending across the machine direction and connecting the rows of pipes 18 together. The discharge ends 20 of the pipes 18 are opening directly out into the slice chamber 12, and said mounting bars 19 are located at these discharge ends 20. The turbulence generator 7 is connected at its upstream end to a feeding system (not shown), comprising two stock supplies and suitable flow distributors for even distribution of each stock to the rows of pipes 18 in the associated pipe section 16, 17 and for even distribution of the stock within each row of pipes 18.

In the embodiment shown, the headbox has five vanes 21, the central vane of which is a stock-separating vane that divides the slice chamber 12 into a lower stock channel 22 and an upper stock channel 23. The lower stock channel 22 communicates with the lower pipe section 16 and the upper stock channel 23 communicates with the upper pipe section 17. Said central separating vane extends some way past the slice opening 15. The remaining vanes 21 are solely turbulence vanes, which have their downstream ends situated inside the slice chamber 12 at a pre-determined distance from the slice opening 15, and divide the stock channels 22, 23 each into three part-stock channels 24 that are united in respective stock channel 22, 23 upstream of the slice opening 15. The vanes 21 are relatively stiff and are produced of a metal material, usually titanium, or a plastic material, usually glass- or carbonfiber-reinforced epoxy plastic. The thickness of the vane within the upstream end portion is normally within the interval 3.0-4.0 mm.

The headbox 1 comprises an arrangement for detachably mounting the upstream end portion 25 of each vane 21, either directly or indirectly, to the turbulence generator 7. The mounting arrangement comprises an engagement member 26 which is connected to the vane 21 at its upstream end portion 25, and an elongate structural element 27. In the embodiment shown in Figures 1 and 2 the structural element 27 is formed by said mounting bar 19 which has an elongate groove 28 for receipt of the upstream end portion 25 of the vane 21 and its engagement member 26 for securing the vane 21 in the machine direction. The groove 28 is open at its ends facing away from each other and has a side opening 29 facing towards the slice chamber 12. The side opening 29 has a width (perpendicular to the vane 21) that is somewhat less than that of the engagement member 26 so that this is retained in the groove 28, and somewhat larger than the thickness

of the vane 21 so that this can be moved without friction along the side opening 29 of the groove 28 during assembly. The height of the groove 28 (perpendicular to the vane) is somewhat larger than that of the engagement member 26 so that this can be moved along the groove 28 without friction during assembly. The vane 21 is suitably bevelled at its rear side so that, even when turned upwards or downwards about the engagement member 26, it runs free from the opposing walls of the groove 28.

In the embodiment shown in Figure 3 the structural element 27 is formed by a special connection bar 30 with which the vane 21 is indirectly detachably mounted on the mounting bar 19. The connection bar 30, produced of a metal such as bronze, is the same length as the width of the vane 21 and comprises a first engagement part 31 situated downstream, a second engagement part 32 situated upstream, and a waist part 33 connecting said engagement parts. The first engagement part 31 is provided with an elongate through-groove 34 for receipt of the upstream end portion 25 of the vane 21 and its engagement member 26 to secure the vane 21 and connection bar 30 to each other seen in the machine direction. The groove 34 is open at its ends facing away from each other and has a side opening 35 facing in the machine direction. The side opening 35 has a width (perpendicular to the vane) which is somewhat less than that of the engagement member 26 so that this is retained in the groove 34, and somewhat larger than the thickness of the vane 21 so that this can be moved without friction along the side opening 35 of the groove 34 during assembly. The height of the groove 34 (perpendicular to the vane) is somewhat larger than that of the engagement member 26 so that this can be moved along the groove 34 without friction during assembly. Inside the groove 34 for the engagement member 26 is an elongate through-guide groove 36 for receipt of the rear edge portion 37 of the vane 21. The guide groove

36 is situated in line with the side opening 35 and has the same width as the latter. The second engagement part 32, having substantially circular cross section, is received in an elongate through groove 38 in the mounting bar 19 to secure the connection bar 30 in machine direction. The groove 38 resembles the groove 28 for the engagement member 26 shown in Figure 2. The groove 38 is thus open at its ends facing away from each other and has a side opening 39 facing towards the slice chamber 12. The side opening 39 has a width (perpendicular to the vane 21) which is somewhat less than that of the engagement part 32 so that this is retained in the groove 38. The height of the groove 38 (perpendicular to the vane) is somewhat larger than that of the engagement part 32 so that this can be moved along the groove 38 without friction during assembly. The thickness of the waist part 33 is somewhat less than the width of the side opening 39 so that the entire connection bar 30, together with the vane 21, is pivotable about the round journalling axis of the engagement part 32 like a hinge. The thickness of the waist part 33 is also so small in relation to the thicknesses of the two engagement parts 31, 32 that the waist part 33 itself becomes flexible. This ensures that the connection bar 30 is not broken at the waist part 33 when a vane 21 is pressed away from its normal freely supported position as a result of a temporary decrease in pressure in one stock channel and/or increase in pressure in the stock channel situated on the other side of the vane 21.

Said engagement member 26 comprises a plurality of oblong engagement bodies 40. The upstream end portion 25 of the vane 21 is provided with a plurality of oblong recesses 41 extending parallel with the transverse, upstream edge 42 of the vane 21 at a predetermined distance therefrom and arranged to receive at least one of said engagement bodies 40 for detachably mounting the engagement body 40

in the upstream end portion 25 of the vane 21. The recesses 41 extend through the thickness of the vane 21. In the embodiment shown in Figures 4-8, each recess has an elongate U shape so that two parallel oblong grooves 43, 44 are formed, see Figure 6, and a short transverse groove 45 joining the grooves 43, 44, said grooves defining an elongate tongue 46 of predetermined width.

The recesses 41 are arranged a predetermined distance from each other and aligned with each other, i.e. at the same distance from the upstream edge 42. The engagement bodies 40 are in the form of straight, oblong engagement pipes or sleeves with axial through-holes 47. The circular engagement pipes 40 are adapted to be slipped onto the tongue 46 of the U recess, said tongue being bendable out to a position so that its free end will be available to receive an engagement pipe 40, as illustrated in Figure 8. In the embodiment shown in Figures 4-8 a first group of long engagement pipes 40a and a second group of short engagement pipes 40b are used. Each such long engagement pipe 40a is provided with two axial, diametrically opposing grooves 48 with a width circumferentially slightly greater than the thickness of the vane 21 in order to allow the engagement pipe 40a to be pushed a corresponding distance in on the vane 21 so that the tongue 46 will protrude through the slit-free rear end of the long engagement pipe 40a. Two short engagement pipes 40b from the second group are then slipped onto the remaining free part of the tongue 46, thereby filling up the remaining part of the recess 41. The distance between two recesses 41 corresponds to the length of the slotted part of the long engagement pipe 40a. It will thus be understood that, after assembly, the engagement pipes 40 will form a continuous row of pipes with the engagement pipes 40 lying end-to-end after each other. The engagement pipes 40 have an external diameter somewhat less than the height of the groove 28 or 34 in

the structural element 27, so that the row of pipes supported by the vane can be slidably displaced along the groove 28 or 34 when the vane 21 is mounted in the structural element 27. In the embodiment shown in Figure 2 the engagement pipes form a pivot about which the vane can turn. In the embodiment shown in Figure 3 the engagement part 32 forms this pivot function.

The engagement pipes is suitably produced of an acid-resistant material and have a diameter within the interval 6-10 mm and a wall thickness of about 1 mm. The long, slitted engagement pipe has a length within the interval 40-100 mm, while the short engagement pipe, when used, has a length within the interval 15-30 mm. The length of a recess is within the interval 30-100 mm and the distance between two recesses is within the interval 30-100 mm. The distance between a recess and the upstream edge of the vane is at least 6 mm, preferably at least 8 mm. It will be realized that said parameters must be carefully adjusted to each other to ensure sufficient strength between two adjacent recesses and between each recess and the upstream edge 42 of the vane.

In the embodiment shown in Figures 9 and 10 the vane 21 is provided with a plurality of oblong recesses 50, rectangular in shape, said recesses 50 extending parallel with the upstream edge 42 of the vane 21 at a predetermined distance therefrom. The recesses 50, which extend through the thickness of the vane 21, are arranged at the same predetermined distance from, and aligned with each other. They are entirely open, i.e. they lack said tongues. The engagement bodies 51 are in the form of straight, oblong engagement pipes, sleeves or solid rods with a width (diameter) and length somewhat less than the recesses 50 so that the engagement bodies 51 can easily be inserted into the recesses 50 to be received therein and retained in centered manner in relation to the vane

21, i.e. each engagement body 51 has parts of the same size situated on the upper and lower sides of the vane 21. Each engagement body 51 is provided with a plurality of side supports 52 in the form of pins or dowels situated on both sides of the vane 21 to keep the engagement body 51 in correct, centered position to facilitate insertion of the engagement bodies 51 into the corresponding grooves of the structural element 27 together with the upstream end portion 25 of the vane 21.

Figure 11 shows a vane 21 manufactured with a concave, circular arc shaped downstream edge 53. The upstream edge 54 may have a corresponding convex shape. The side edges 55 may also be shaped with inclined alignment in relation to the machine direction, as shown, i.e. they suitably coincide with radii to the concave, circular arc shaped downstream edge 53. The engagement bodies 40 are shaped and arranged in the same way as those in Figure 6 to form a continuous pivot. They extend in a circular arc that is concentric with the concave downstream edge 53. s designates a minimum width of the groove 28 in the structural element 27 in order to enable friction-free insertion of the engagement bodies 40 and the upstream end portion 25 of the vane 21 into the groove 28 along its entire length. The vane 21 is produced of a liquid-absorbing, glassfiber-reinforced plastic material. The force, indicated by a large arrow, exerted on the vane by the flows of stock causes the vane to be stretched forwards and laterally so that the vane is straightened out to rectangular form as shown in Figure 12, the two smaller arrows indicating tensile stresses in the downstream end portion of the vane. If deemed suitable, the engagement bodies 40 may be arranged only within limited portions, seen from the two side edges 55 of the vane, so that a central portion is free from engagement bodies.

The invention is also applicable to a two-part vane for detachable mounting of the two vane sections to each other, in which case the vane 21 is suitably mounted to the turbulence generator 7 as described above. Such an embodiment is shown in Figure 13, where the vane 21 is divided into an upstream vane section 56 and a downstream vane section 57. The downstream vane section 57 is provided with a row of engagement bodies 40 at its upstream end portion 58 in the same way as described above for the undivided vane 21, said engagement bodies 40 being received in oblong recesses 50, provided with tongues, as described above. The downstream end part 59 of the upstream vane section 56 of the vane is in this case made as an engagement part corresponding to the first engagement part 31 in the embodiment in accordance with Figure 3 as regards the shape and location of the groove 34.

The engagement bodies are manufactured in a simple and inexpensive manner, e.g. of commercially available pipe of suitable quality, by simply cutting the pipe into the desired lengths and providing some of them with axial slits in accordance with the embodiment described above. The recesses for the engagement bodies are also simple to prepare with the necessary tolerance in the vane, e.g. using a blanking die. The engagement bodies adapted to the recesses are placed simply and quickly in the recesses.

C L A I M S

1. A headbox for delivering a jet of stock to a forming zone in a former for wet-forming a fiber web, comprising
- a slice (8) having a slice chamber (12) and a slice opening (15),
- a turbulence generator (7) for supplying at least one stock to the slice chamber (12),
- at least one vane (21) arranged in the slice chamber (12), and
- an arrangement for detachably mounting the upstream end portion (25) of the vane (21) in the headbox, said arrangement comprising
  - an engagement member (26) connected to the vane (21) at said upstream end portion (25), and
  - an elongate structural element (27) with a longitudinal groove (28; 34) and being open at its opposing ends for receipt of the upstream end portion (25) of the vane (21) and its engagement member (26) for securing the vane (21) in the machine direction,

characterized in that the engagement member (26) comprises a plurality of oblong engagement bodies (40; 51) and that the upstream end portion (25) of the vane (21) is provided with a plurality of oblong recesses (41; 50) of predetermined length, said recesses being arranged at predetermined distance from each other, extending parallel with the upstream edge (42) of the vane (21) at a predetermined distance therefrom and being arranged to receive at least one of said engagement bodies (40; 51) for detachably mounting the engagement body (40; 51) in the upstream end portion (25) of the vane (21).

2. A headbox as claimed in claim 1, characterized in that said structural element (27) consists of a mounting bar (19) that is rigidly mounted to said turbulence

generator (7) or forms an integral part of the turbulence generator (7) and is provided with said groove (28) for receiving the upstream end portion (25) of the vane (21) and its engagement bodies (40; 51).

3. A headbox as claimed in claim 1, characterized in that said structural element (27) consists of a connection bar (30) forming a pivot and having a first engagement part (31) and a second engagement part (32), said second engagement part (32) being designed for assembly into a groove (38) in the mounting bar (19) rigidly mounted to said turbulence generator (7) or forming an integral part of the turbulence generator (7), and said first engagement part (31) being provided with said groove (34) for receiving the upstream end portion (25) of the vane (21), and its engagement bodies (40; 51).

4. A headbox as claimed in any one of claims 1-3, wherein the vane (21) comprises at least two vane sections (56, 57) arranged one after the other, characterized in that a second structural element, having the same function as the first structural element (27), is formed by the downstream end portion (59) of the upstream vane section (56), provided with a through-groove (34) extending in the cross-machine direction, and the upstream end portion (58) of the downstream vane section (57) being provided with said engagement member (26).

5. A headbox as claimed in any one of claims 1-4, characterized in that the engagement bodies (40) are hollow, having an axial through-hole (47), and that each recess (41) is shaped as an elongate U with two parallel grooves (43, 44) and an intermediate tongue (46) arranged to be received in the hole (47) of the engagement body

(40) in order to support at least a part of the engagement body (40).

6. A headbox as claimed in claim 1, characterized in that engagement bodies (40a) of a first group are provided with two oblong, diametrically arranged groves (48), the width of which is slightly greater than the thickness of the vane (21) within the upstream end portion (25), the grooved engagement body (40a) being arranged to be brought into engagement with its grooved part with the vane (21) in the extension of the recess (41) at the root of the tongue (46) of the recess (41).

7. A headbox as claimed in claim 6, characterized in that the part of the engagement body (40a) free from grooves is arranged to occupy the entire length of the recess (41).

8. A headbox as claimed in claim 6, characterized in that the part of the engagement body (40a) free from grooves is arranged to occupy a part of the recess (41), the engagement bodies (40b) of a second group being free from grooves and having a length that occupy the remaining part of the recess (41) or a multiple thereof, said length corresponding to such a multiple.

9. A headbox as claimed in claim 1, characterized in that the length of the recesses (41), distances between the recesses (41) and the length or lengths of the engagement bodies (40) are so adapted to each other that the engagement bodies (40) form a continuous row in an end-to-end relationship from one side of the vane (21) to its other side.

10. A headbox as claimed in any one of claims 1-3, 5-9, characterized in that the vane (21) is manufactured of a plastic material with a concave, circular arc shaped

downstream edge (53) and in that said recesses (41) and their said engagement bodies (40) are arranged in a circular arc concentric with said concave downstream edge (53), said downstream edge (53) being straightened out during operation due to the influence of shearing forces exerted on the vane (21) by the stocks.

11. An arrangement in a headbox for detachable mounting of the upstream end portion (25) of a vane (21) therein, said headbox being arranged to deliver a jet of stock to a forming zone in a former for wet-forming a fiber web and comprising

- a slice (8) having a slice chamber (12) and a slice opening (15),
- a turbulence generator (7) for supplying at least one stock to the slice chamber (12), and
- at least one vane (21) arranged in the slice chamber (12),

said arrangement comprising

- an engagement member (26) connected to the vane (21) at said upstream end portion (25), and
- an elongate structural element (27) with a longitudinal groove (28; 34) and being open at its opposing ends for receipt of the upstream end portion (25) of the vane (21) and its engagement member (26) for securing the vane (21) in the machine direction,

characterized in that the engagement member (26) comprises a plurality of oblong engagement bodies (40; 51) and that the upstream end portion (25) of the vane (21) is provided with a plurality of oblong recesses (41; 50) of predetermined length, said recesses being arranged at predetermined distance from each other, extending parallel with the upstream edge (42) of the vane (21) at a predetermined distance therefrom and being arranged to receive at least one of said engagement bodies (40; 51) for detachably mounting the engagement

body (40; 51) in the upstream end portion (25) of the vane (21).

12. An arrangement as claimed in claim 11, characterized in that said structural element (27) consists of a mounting bar (19) that is rigidly mounted to said turbulence generator (7) or forms an integral part of the turbulence generator (7) and is provided with said groove (28) for receiving the upstream end portion (25) of the vane (21) and its engagement bodies (40; 51).

13. An arrangement as claimed in claim 12, characterized in that said structural element (27) consists of a connection bar (30) forming a pivot and having a first engagement part (31) and a second engagement part (32), said second engagement part (32) being designed for assembly into a groove (38) in the mounting bar (19) rigidly mounted to said turbulence generator (7) or forming an integral part of the turbulence generator (7), and said first engagement part (31) being provided with said groove (34) for receiving the upstream end portion (25) of the vane (21), and its engagement bodies (40; 51).

14. An arrangement as claimed in any one of claims 11-13, wherein the vane (21) comprises at least two vane sections (56, 57) arranged one after the other, characterized in that a second structural element, having the same function as the first structural element (27), is formed by the downstream end portion (59) of the upstream vane section (56), provided with a through-groove (34) extending in cross-machine direction, and the upstream end portion (58) of the downstream vane section (57) being provided with said engagement member (26).

15. An arrangement as claimed in any one of claims 11-14, characterized in that the engagement bodies (40) are hollow, having an axial through-hole (47), and that each recess (41) is shaped as an elongate U with two parallel grooves (43, 44) and an intermediate tongue (46) arranged to be received in the hole (47) of the engagement body (40) in order to support at least a part of the engagement body (40).

16. An arrangement as claimed in claim 11, characterized in that engagement bodies (40a) of a first group are provided with two oblong, diametrically arranged grooves (48), the width of which is slightly greater than the thickness of the vane (21) within the upstream end portion (25), the grooved engagement body (40a) being arranged to be brought into engagement with its grooved part with the vane (21) in the extension of the recess (41) at the root of the tongue (46) of the recess (41).

17. An arrangement as claimed in claim 16, characterized in that the part of the engagement body (40a) free from grooves is arranged to occupy the entire length of the recess (41).

18. An arrangement as claimed in claim 16, characterized in that the part of the engagement body (40a) free from grooves is arranged to occupy a part of the recess (41), the engagement bodies (40b) of a second group being free from grooves and having a length that occupy the remaining part of the recess (41) or a multiple thereof, said length corresponding to such a multiple.

19. An arrangement as claimed in claim 11, characterized in that the length of the recesses (41), distances between the recesses (41) and the length or lengths of the engagement bodies (40) are so adapted to each other that the engagement bodies (40) form a continuous row in

an end-to-end relationship from one side of the vane (21) to its other side.

20. An arrangement as claimed in any one of claims 11-13, 15-19, characterized in that the vane (21) is manufactured of a plastic material with a concave, circular arc shaped downstream edge (53) and in that said recesses (41) and their said engagement bodies (40) are arranged in a circular arc concentric with said concave downstream edge (53), said downstream edge (53) being straightened out during operation due to the influence of shearing forces exerted on the vane (21) by the stocks.

Fig. 1

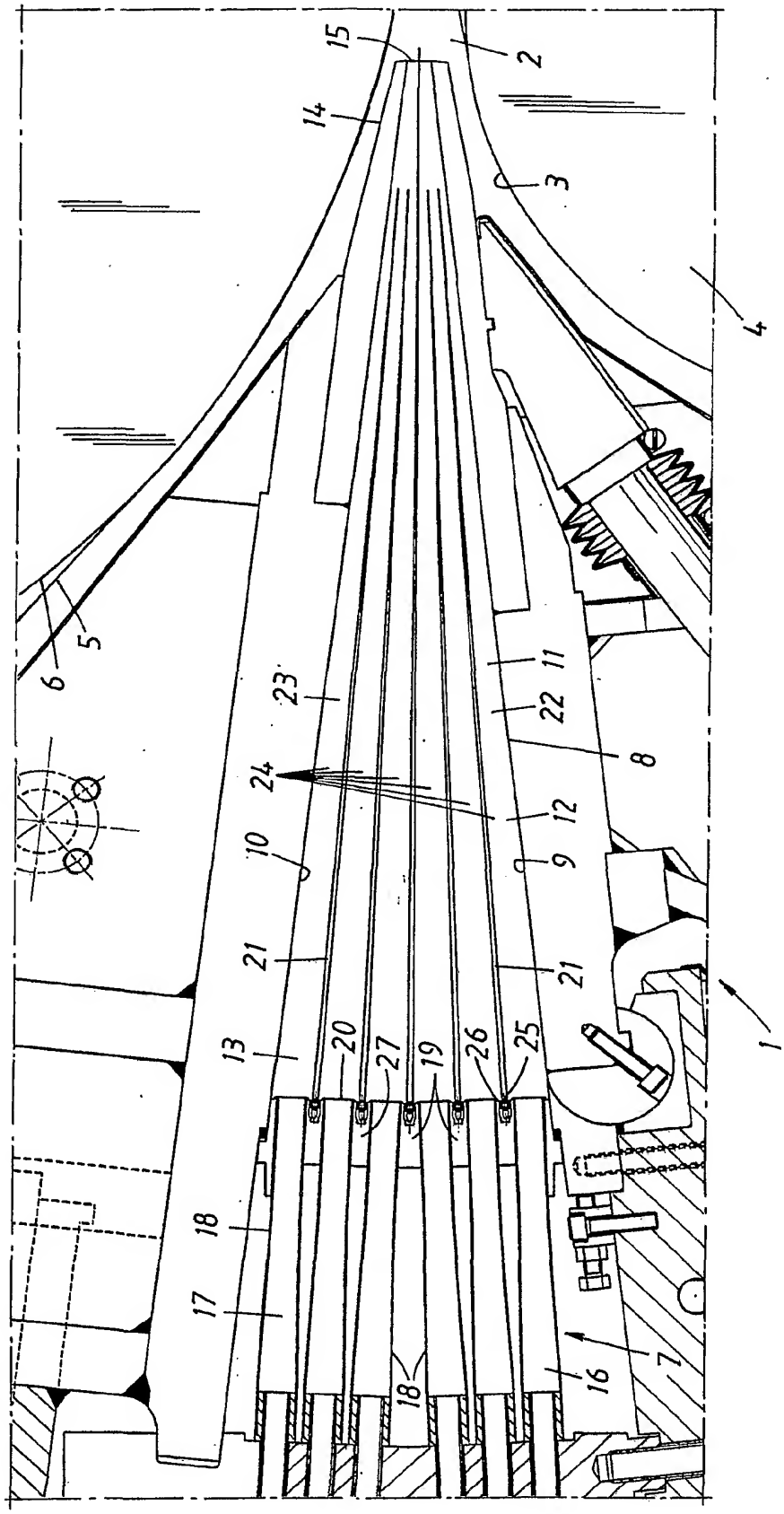

Fig. 2

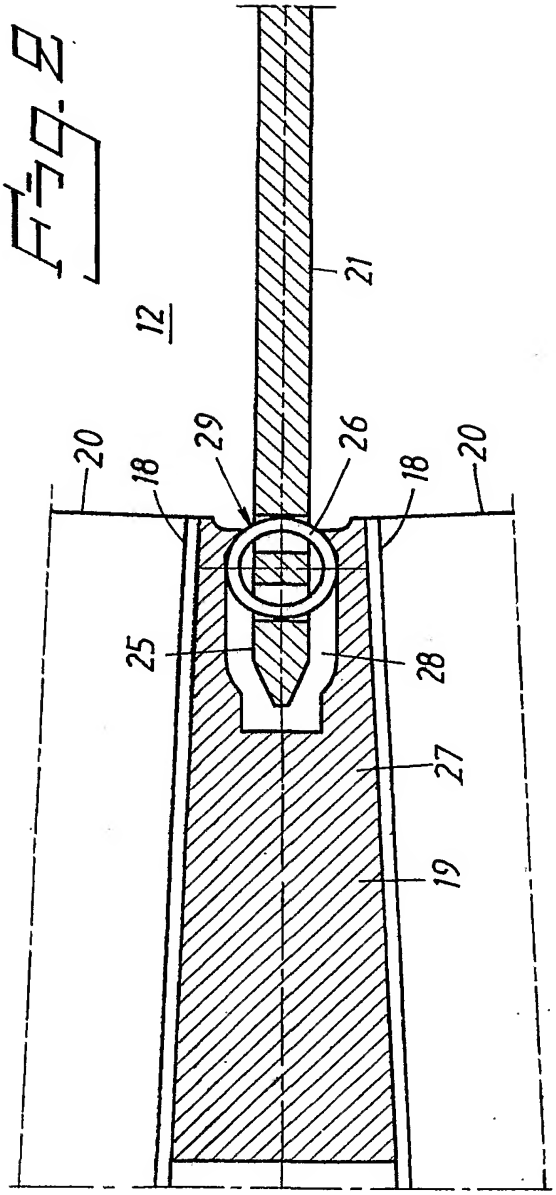
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Fig. 3

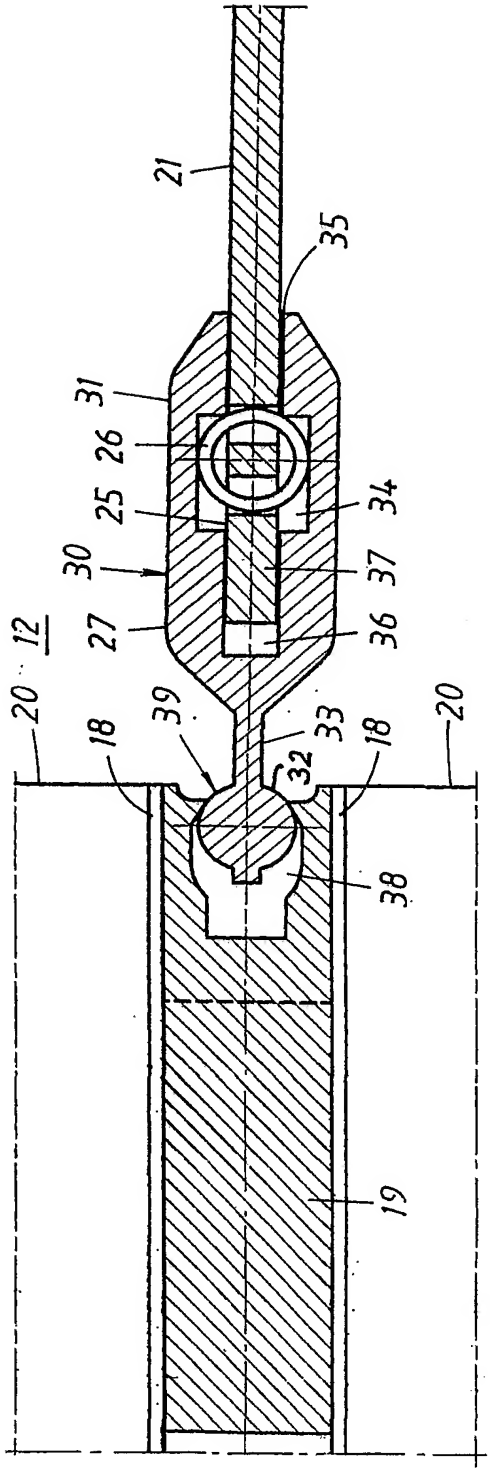
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Fig. 4

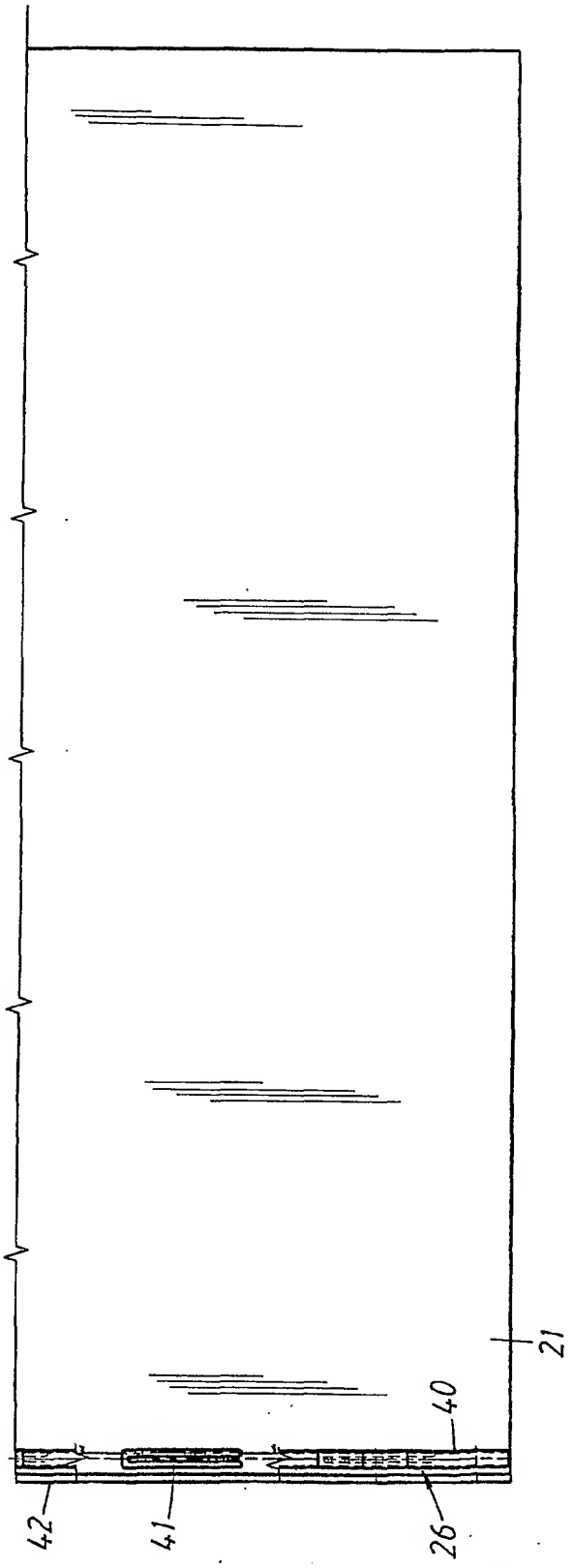


Fig. 5

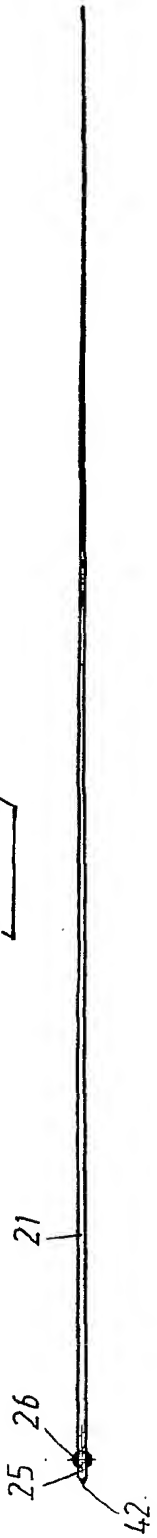


Fig. 8

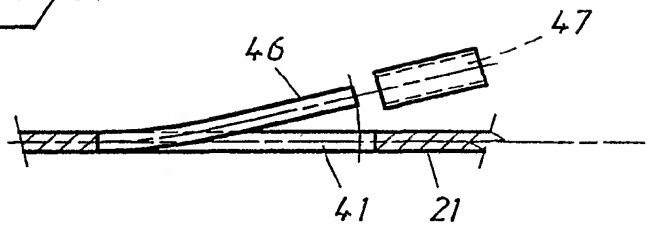


Fig. 6

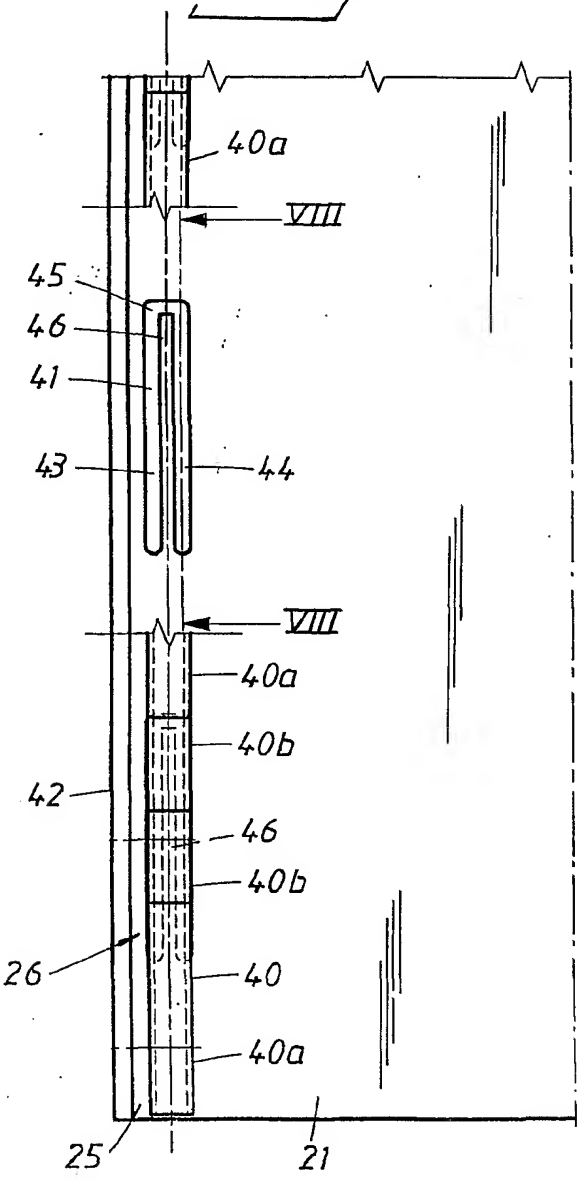


Fig. 7

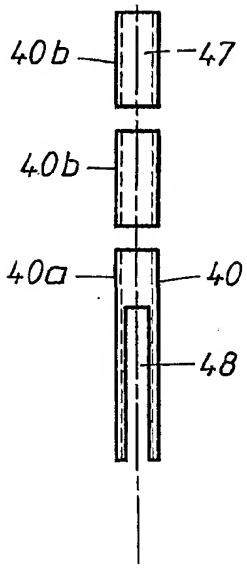


Fig. 9

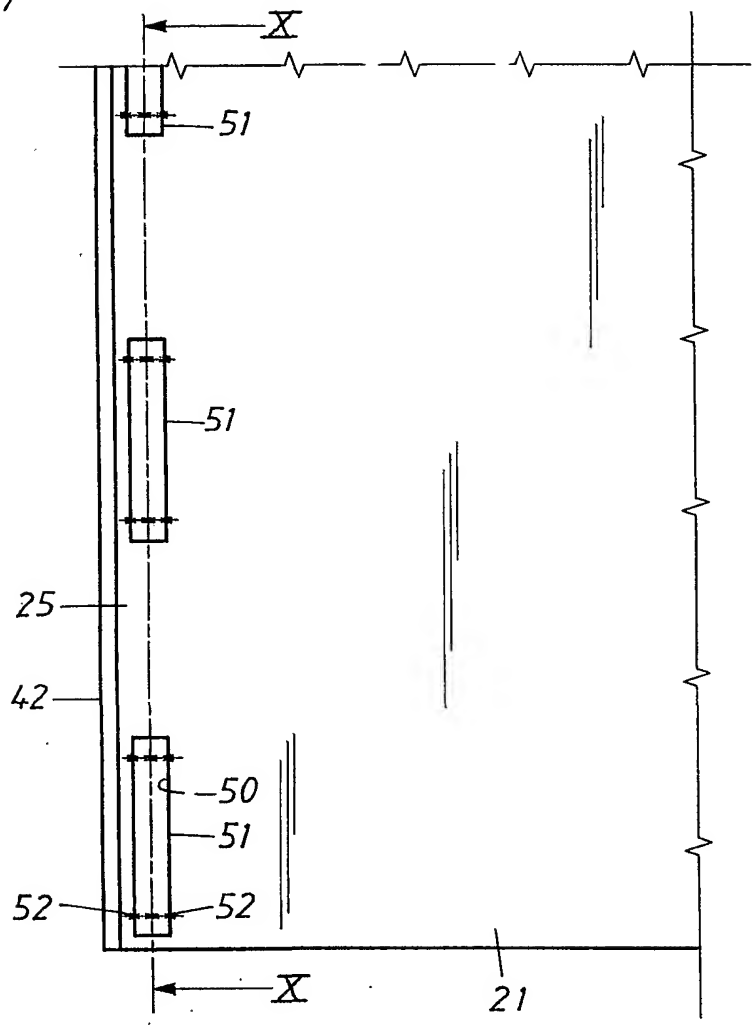


Fig. 10

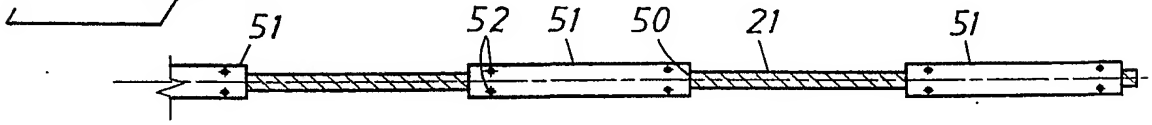
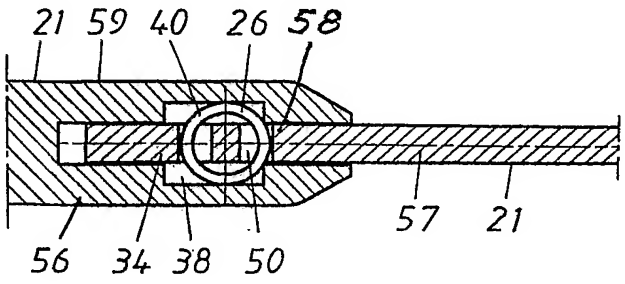


Fig. 13



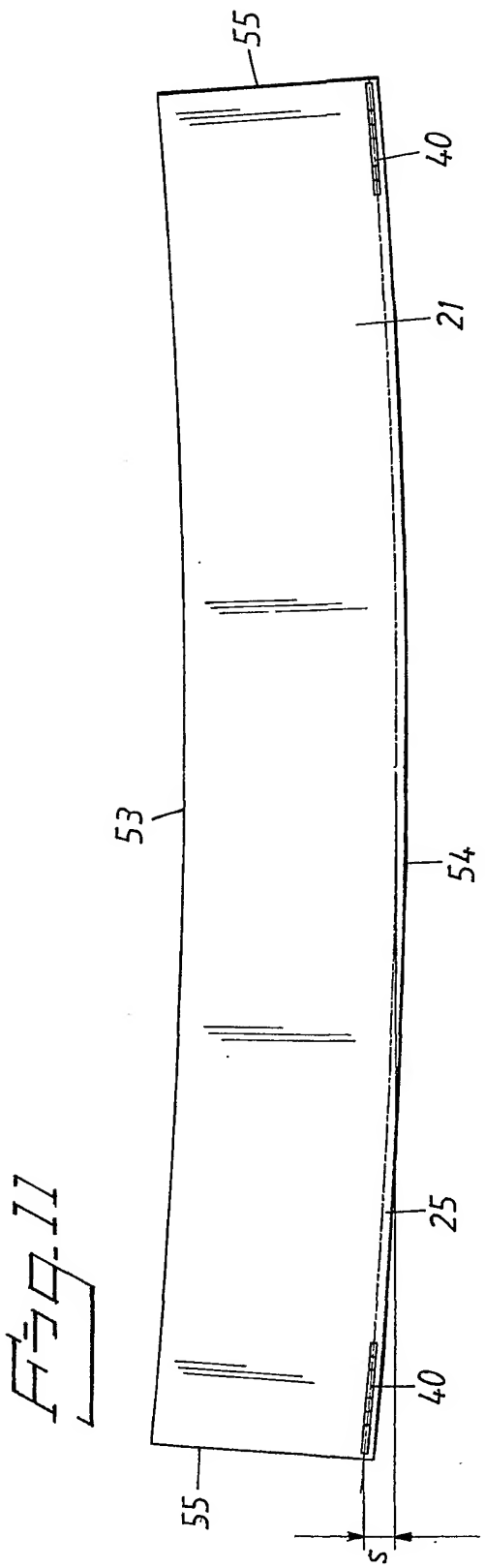


Fig. 11

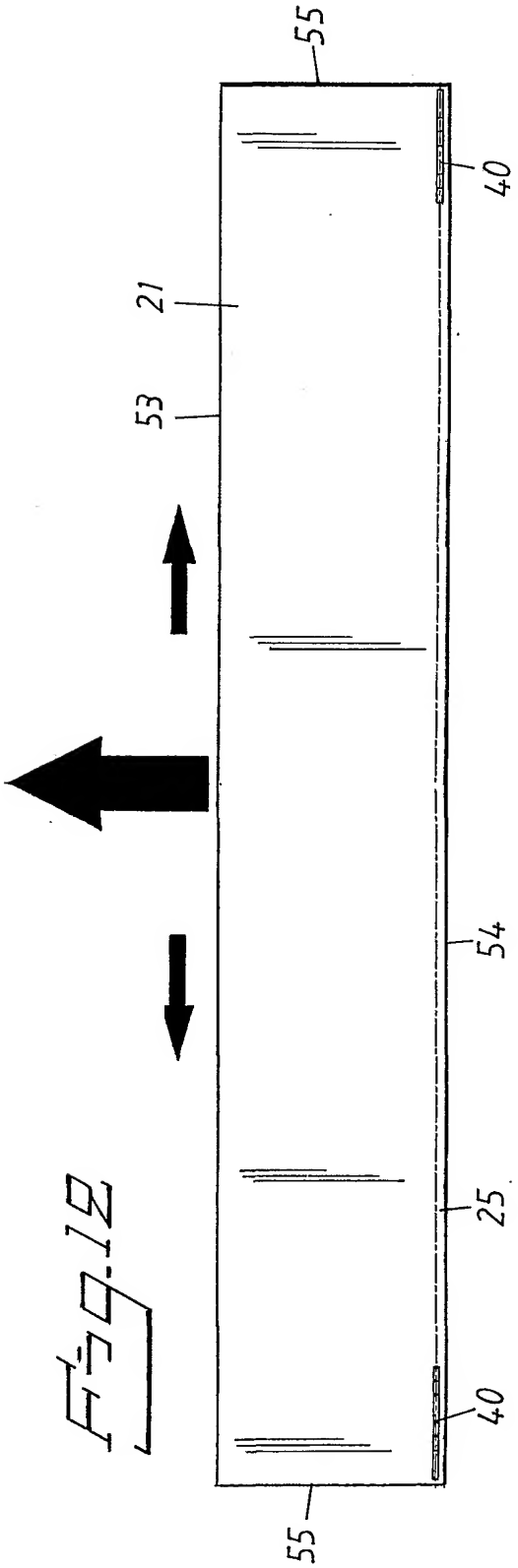


Fig. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 01/01344

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21F 1/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SE 511684 C2 (VALMET-KARLSTAD AB), 8 November 1999 (08.11.99), figures 1,5-7, claim 1	1-20

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 Sept 2001	27 -09- 2001
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Wiva Asplund/ELY Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/SE 01/01344

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE 511684 C2	08/11/99	AU 7091198 A	11/11/98
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